COMMISSION OF THE EUROPEAN COMMUNITIES

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Brussels, 18 October 1977

Proposal for a

COUNCIL DIRECTIVE

on the approximation of the laws of the Member States

relating to

HOT-WATER METERS

(submitted to the Council by the Commission)

EXPLANATORY MEMORANDUM

1. General

This directive has been drawn up in pursuance of Article 100 of the Treaty and of the Council Directive of 26 July 1971 on the approximation of the laws of the Member States relating to common provisions for both measuring instruments and methods of metrological inspection (1).

It is aimed at guaranteeing the access to the entire Common Market of hot water meters which satisfy the prescriptions of this Directive.

It is also designed to prevent the creation of new obstacles through the introduction of different laws, regulations or administrative provisions in Member States which so far have no national legislation on the subject.

A comparative study of the rules applicable to hot-water meters has revealed differences in the technical specifications for construction and use, as well as in the classes of accuracy and the methods of inspection to which these meters are subject before they can be marketed and put to use.

As the present national laws are justified by the legitimate wish to protect the consumer and the user, the harmonization of these laws has emerged as the only likely means of overcoming the difficulties caused by the discrepancies, and of creating the conditions necessary for the establishment of the common market.

Furthermore, the harmonization of the laws relating to hot-water meters is in line with the general policy of aimed at the rational use of energy to which not only the nine Member States but also the majority of industrialized countries are committed.

The rise in the price of oil over the last few years has led most of these countries to review their consumption forecasts with a view to cutting down expenditure. Efforts have been made in most branches of industry either to cut down consumption or to rationalize the use of energy.

At the same time, demographic developments, urbanization, advances in hygiene and life-style and finally the process of industrialization have been demanding ever greater quantities of water, and in particular of hot water.

Although for many years the local distribution services, both public and private, were able to adopt varying criteria for the supply of their customers, the time has come when this kind of laxity is no longer permitted, since present-day market conditions have made hot water a costly product.

Moreover, the efforts to protect the consumer that have been undertaken over the past few years have resulted in most of the Member States exercising stricter control over the quantities of water used by having meters installed on each consumer's premises.

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(1) O.J. N° L 202 of 6 September 1971, page 1.

All these considerations underline the importance of harmonization, which, apart from furthering the main objectives of the Council with regard to the free movement of goods and greater protection for the consumer, will also enable better control to be exercised over the energy consumed.

Once this directive has been adopted by the Council, the Commission will be able to put forward a proposal in connection with thermal energy meters, the need for which is being felt ever more acutely.

Since, in most cases, the hot-water meters covered by this proposal are one of the main components of thermal energy meters, the work of harmonizing the latter will be facilitated by the fact that the hot-water meters will already have been harmonized when the directive on thermal energy meters is adopted.

2. Structure of the directive

Like most of the directives already adopted by the Council in the measuring instruments sector, this directive comprises a legal instrument and a technical annex.

The specifications contained in the annex define the main concepts to be employed, and list all the characteristics which hot-water meters must possess and the tests they must successfully undergo before they can move freely within the Community.

3. Harmonization solution

As in most of the special directives in this field, the harmonization solution that has been adopted is the one known as "optional". This solution is permitted, along with "total" harmonization, by the Council Directive of 26 July 1971 relating to common provisions for both measuring instruments and methods of metrological control.

Until such time as the main non-technical provisions have been harmonized - especially those relating to the use of hot-water meters and the inspection charges - the solution of total harmonization is likely to raise serious problems.

Optional harmonization means that hot-water meters conforming to this directive could be marketed freely between Member States and within Member States in the same way as meters that comply with national requirements can be marketed in the particular State concerned.

4. Consultation of the Parliament and the Economic and Social Committee

The opinion of these two bodies is required under the provisions of Article 100 (2). For some Member States, the implementation of the provisions of the directive will require an amendment to their national laws.

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Proposal for a Council Directive on the approximation of the laws of the Member States relating to hot-water meters

(Submitted by the Commission to the Council on 24 October 1977)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament,

Having regard to the opinion of the Economic and Social Committee,

Whereas in the Member States the construction and the methods of inspecting hot-water meters are subject to mandatory provisions which differ from one Member State to another and consequently hinder trade in such instruments; whereas it is therefore necessary to approximate these provisions;

Whereas Council Directive 71/316/EEC of 26 July 1971 on the approximation of the laws of the Member States relating to common provisions for both measuring instruments and methods of metrological control (1), as amended by the Act of Accession (2), laid down the EEC pattern-approval and EEC initial verification procedures; whereas, in accordance with that Directive, there should be laid down the technical requirements relating to the design and functioning which hot-water meters must satisfy in order to be freely imported, marketed and used, after inspection and the affixing of the appropriate signs and marks,

HAS ADOPTED THIS DIRECTIVE:

Article 1

This Directive shall apply to hot-water meters intended for the continuous determination of the volume of hot water passing through them. Such meters shall be provided with a measuring device linked to an indicating device. For the purpose of this Regulation, hot water shall be water, the temperature of which exceeds 30 °C but does not exceed 90 °C.

Article 2

Hot-water meters to which the EEC marks and signs may be affixed are described in the Annex to this Directive. They shall be subject to EEC pattern-approval and shall be submitted for EEC initial verification.

Article 3

No Member State may refuse, prohibit or restrict the placing on the market or entry into service of hot-water meters bearing the EEC pattern-approval and the EEC initial verification mark, on the grounds of their metrological properties.

Article 4

1. Member States shall bring into force the laws, regulations and administrative provisions needed in order to comply with this Directive within 18 months of its notification and shall forthwith inform the Commission thereof.

2. Furthermore, after notification of this Directive, Member States shall ensure that the Commission is informed, in time for it to submit its comments, of any draft laws, regulations or administrative provisions which they intend to adopt in the field covered by this Directive.

Article 5

This Directive is addressed to the Member States.

(1) OJ No L 202, 6. 9. 1971, p. 1.
(2) OJ No L 73, 27. 3. 1972, p. 14.

ANNEX

I. TERMINOLOGY AND DEFINITIONS

1.0. This Annex applies only to hot-water meters based on a direct mechanical process involving the use of volumetric chambers with mobile walls or the action of the velocity of the water on the rotation rate of a moving part (turbine, impeller etc.).

1.1. *Flowrate*

The flowrate is the volume of water passing through the meter per unit of time.

1.2. *Volume delivered*

The volume delivered is the total volume of water which has passed through the meter in a given time.

1.3. *Maximum flowrate* (Q_{max})

The maximum flowrate, Q_{max}, is the highest flowrate at which the meter can function over limited periods without damage, and without exceeding the maximum permissible errors and the maximum permissible value for loss of pressure.

1.4. *Nominal flowrate* (Q_n)

The nominal flowrate, Q_n, is equal to half the maximum flowrate, Q_{max}. It is expressed in cubic metres per hour and is used to designate the meter.

At the nominal flowrate, Q_n, the meter should be able to function in normal use, i.e., in continuous and intermittent operating conditions, without exceeding the maximum permissible errors.

1.5. *Minimum flowrate* (Q_{min})

The minimum flowrate, Q_{min}, is the flowrate above which the meter must not exceed the maximum permissible errors, and is fixed as a function of Q_{max}.

1.6. *Flowrate range*

The flowrate range of a water meter is bounded by the maximum and minimum flowrates, Q_{max} and Q_{min}. It is divided into two regions, termed upper and lower, with different maximum permissible errors.

1.7. *Transitional flowrate* (Q_t)

The transitional flowrate, Q_t, is the flowrate which divides the upper and lower regions of the flow range and the rate at which the maximum permissible errors become discontinuous.

1.8. *Maximum permissible error*

The maximum permissible error is the limit of the error permitted by this Directive for EEC pattern-approval and EEC initial verification of a water meter.

1.9. *Loss of pressure*

Loss of pressure means the loss which is caused by the presence of the water meter in the conduit.

II. METROLOGICAL CHARACTERISTICS

2.1. *Maximum permissible errors*

The maximum error permitted in the lower region, from Q_{min} inclusive to Q_t non-inclusive, is ± 5 %.

The maximum error permitted in the upper region, from Q_t inclusive to Q_{max} inclusive, is ± 3 %.

2.2. *Metrological classes*

Hot-water meters are divided according to the values of Q_{min} and Q_t defined above, into the four metrological classes in the following table:

Classes	Q_n	
	< 15 m³/h	⩾ 15 m³/h
Class 0:		
— value of Q_{min}	0·08 Q_n	0·16 Q_n
— value of Q_t	0·15 Q_n	0·30 Q_n
Class A:		
— value of Q_{min}	0·04 Q_n	0·08 Q_n
— value of Q_t	0·10 Q_n	0·20 Q_n
Class B:		
— value of Q_{min}	0·02 Q_n	0·04 Q_n
— value of Q_t	0·08 Q_n	0·15 Q_n
Class C:		
— value of Q_{min}	0·01 Q_n	0·02 Q_n
— value of Q_t	0·06 Q_n	0·10 Q_n

III. TECHNOLOGICAL CHARACTERISTICS

3.1. Construction — General provisions

The meters must be constructed in such a way as to:

1. give long service and guarantee proof against fraud;

2. conform with the provisions of this Directive, under normal conditions of use.

Where meters may be subjected to an accidental reversal of flow they must be capable of withstanding it without any deterioration or change in their metrological properties, and at the same time should record such a reversal.

3.2. *Materials*

The water meter must be made of materials of adequate strength and stability for the purpose for which the water meter is to be used. It must be constructed throughout of materials which are resistant to internal and normal external corrosion and if necessary be protected by some suitable surface treatment. Water temperature variations within the temperature range 0 °C to 110 °C must not adversely affect the materials used in the construction of the water meter.

3.3. *Soundness — pressure tightness and temperature resistance*

A meter must be able to withstand constantly — without defects in its functioning, leakage, seepage through the walls or permanent deformation — a continuous water temperature of 90 °C and the pressure for which it is designed, termed the maximum operating pressure. The minimum value for this pressure is 10 bars.

3.4. *Loss of pressure*

Loss of pressure through the meter is determined by EEC pattern-approval tests, and must not exceed 0·25 bars at the nominal flowrate and one at the maximum flowrate.

On the basis of the test results meters are divided into one of four groups with the following maximum values for pressure loss: 1, 0·6, 0·3 and 0·1 bars. The relevant value must be indicated in the EEC pattern-approval certificate.

3.5. *Indicating mechanisms*

The indicator must allow, by simple juxtaposition of its various constituent elements, a reliable, easy and unambiguous reading of the volume of water measured, expressed in cubic metres. The volume must be given either by:

(a) the position of one or more pointers on circular scales;

(b) reading off a row of in-line consecutive digits in one or more apertures;

(c) a combination of these two systems.

A cubic metre and its multiples are indicated in black, and sub-multiples of a cubic metre in red.

The actual or apparent height of the digits must not be less than 4 mm.

On digital indicators (types (b) and (c)) visible displacement of all digits must be upwards in value. The advance of any given digital unit must be completed while the digit of the immediately next lower value describes the last tenth of its course.

The roller showing the digits of the lowest value may move continuously in the case of type (c). The whole number of cubic metres must be clearly indicated.

Indicators with pointers (types (a) and (c)) should rotate in a clockwise direction. The value in cubic metres for each scale division should be expressed as 10^n, where n is a positive or negative whole number or zero, thereby establishing a system of consecutive decades. Data such as the following should be shown near each part of the scale: × 1 000 - × 100 - × 10 - × 1 - × 0·1 - × 0·01 - × 0·001.

In both cases (dial and digital indicators):

— the unit symbol m^3 should be shown either on the dial or in the immediate vicinity of the digital indication,

— the fastest-moving visible graduated element — the monitoring element (the scale interval of which is known as the 'verification scale interval') — should move continuously. This monitoring element may be permanent or may be fitted temporarily by adding detachable parts. These parts must not have any significant influence on the metrological properties of the meter.

The length of the verification scale interval should be not less than 1 mm and not more than 5 mm. The scale shall consist:

— either of lines of equal thickness not exceeding one-quarter of the distance between the axes of two consecutive lines and differing only in length,

— or of contrasting bands of a constant width equal to the length of the scale division.

However, until 19 June 1981:

(a) the downward movement of digits will be permitted, this movement being indicated by an arrow;

(b) the length of the scale division may be 0·8 mm.

3.6. *Number of figures in the verification scale division and their values*

It must be possible for the indicating device to record a volume, expressed in cubic metres, corresponding to at least 1 999 hours' operation at the nominal flowrate, without returning to zero.

The size of the verification scale division must be based on the formula 1×10^n or 2×10^n or 5×10^n. During verification, it must be small enough to ensure a measurement inaccuracy of not more than 0·5 % (allowing for a possible reading error of not more than half the length of the smallest scale division) and small enough so that at the minimum flowrate the test does not take more than 1h30.

A supplementary device (star, disc with a reference mark, etc.) may be added in order to show the movement of the measuring device before this becomes clearly visible on the indicator.

3.7. *Adjusting device*

The meters may be fitted with an adjusting device with which it is possible to alter the relationship between the volume indicated and the volume actually passed. This device is compulsory for meters which use the action of the velocity of the water on the rotation of a moving part.

3.8. *Accelerating device*

The use of an accelerating device for increasing the speed of the meter below Q_{min} is prohibited.

3.9. *Additional devices*

Meters may include a pulse-generating device provided that the device does not appreciably affect their metrological properties.

The pattern approval certificate may provide for the addition of special fixed or detachable devices to permit automatic verification of the meters.

IV. MARKS AND INSCRIPTIONS

4.1. *Identification inscriptions*

All meters must have clearly and indelibly inscribed upon them the following items of information, which may be either grouped together or entered at separate points on the casing, the indicator dial or the data plate:

(a) the manufacturer's name or trade name or his trademark;

(b) the metrological class and nominal flowrate Q_n in cubic metres per hour;

(c) the year of manufacture and the individual production number;

(d) one or two arrows showing the direction of flow;

(e) the EEC pattern-approval mark;

(f) the maximum operating pressure in bars, where this may exceed 10 bars;

(g) the maximum operating temperature in the form: 90 °C;

(h) the letter 'V' or 'H' if the meter can operate properly only in the vertical (V) or horizontal (H) position.

4.2. *Positioning of verification marks*

Space for the EEC verification marks should be provided on an essential part (normally the meter casing), which is visible without dismantling.

4.3. *Sealing*

Meters must be fitted with protective devices which can be sealed in such a way as to ensure, both before and after installation, that neither the meter itself nor its adjusting device can be dismantled or altered without damaging the protective devices.

V. EEC PATTERN-APPROVAL

5.1. *Procedure*

The EEC pattern-approval procedure will be carried out in accordance with Directive 71/316/EEC.

5.2. *Pattern tests*

When it has been ascertained from the application file that the pattern conforms to the provisions of this Directive, laboratory tests will be carried out on a number of instruments under the following conditions:

5.2.1. Number of meters to be tested.

The number of meters to be submitted by the manufacturer is as shown in the following table:

Nominal flowrate, Q_n, m^3/h	Number of meters
Under 1·5	10
Not less than 1·5 but less than 15	3
Not less than 15	2

Depending on how the tests progress, additional specimen meters may be required.

5.2.2. Pressure

For the metrological tests (item 5.2.4), the pressure at the meter outlet should be sufficiently high to prevent cavitation.

5.2.3. Test equipment

In general, meters shall be tested individually and, in all cases, in such a way as to demonstrate accurately the individual characteristics of each.

The metrological service of the Member State shall take the necessary steps to ensure that the maximum relative inaccuracy in measuring the volume of water delivered does not exceed 0·3 % after allowance is made for the various causes of error in installation.

The maximum permissible inaccuracy is 5 % in the case of measurement of pressure and 2·5 % in the case of measurement of loss of pressure.

During each test, the relative variation in the flowrates must not exceed 2·5 % between Q_{min} and Q_t and 5 % between Q_t and Q_{max}.

The maximum permissible inaccuracy in the measurement of temperature is 1 °C.

The equipment must be approved by the metrological service of the Member State concerned no matter where these tests are carried out.

5.2.4. Test procedure.

The tests comprise the following operations, carried out in the order shown:

1. pressure tightness test;
2. determination of the error curves on the basis of the flowrate by ascertaining the effect of the pressure and temperature and taking into account the normal installation conditions for this type of meter (straight sections of piping upstream and downstream of the meter, constrictions, obstacles, etc.) stipulated by the manufacturer;
3. determination of pressure losses;
4. accelerated endurance test;
5. a thermal shock resistance test for meters with a nominal flowrate Q_n of not more than 10 m³/h.

The pressure tightness test is conducted in two parts at 85 (± 5) °C:

(a) each meter should be able to withstand, without leakage or seepage through the walls, a pressure of 16 bars or 1·6 times the maximum operating pressure, applied for a period of 15 minutes (see item 4.1 (f)),

(b) each meter should be able to withstand, without any damage or blockage, a pressure of 20 bars or twice the maximum operating pressure, applied for a period of one minute (see item 4.1 (f)).

The results of tests (2) and (3) should provide a sufficient number of points to enable the curves to be plotted accurately throughout the operating range.

The accelerated endurance test is to be carried out as follows:

Nominal flowrate of meter	Test flowrate and temperature	Type of test	Number of interruptions	Duration of pauses	Period of operation at test flowrate	Duration of start-up and rundown (sec.)
$Q_n \leq 10$ m³/h	Q_n and (50 ± 5) °C	dis-conti-nuous	100 000	15 s	15 s	0·015 (Q_n) [1] minimum 1 s
	Q_{max} and (85 ± 5) °C	conti-nuous			100 h	
$Q_n > 10$ m³/h	Q_n and (50 + 5) °C	conti-nuous			500 h	
	Q_{max} and (85 ± 5) °C	conti-nuous			200 h	

[1] (Q_n) is a number equal to the value of Q_n expressed in m³/h.

Before the first test and on completion of each test series the measuring errors must be determined, as a minimum requirement, at the following flowrates:

$$Q_{min} - Q_t - 0{\cdot}5\ Q_n - Q_{max}$$

In each test, the volume of water passed through the meter must be sufficient to rotate the pointer or the roller on the verification scale through one or more complete revolutions and to eliminate the effects of cyclic distortion.

The thermal shock resistance test shall be carried out at 25 cycles as follows:

Water temperature	Q	Durtion
90 °C	Q_{max}	8 minutes
—	O	1 to 2 minutes
15 °C	Q_{max}	8 minutes
—	O	1 to 2 minutes

5.2.5. Conditions for EEC pattern-approval.

A water meter pattern shall be approved if:

(a) it conforms with the administrative, technical and metrological provisions of this Directive and its Annex;

(b) tests 1, 2 and 3 listed in item 5.2.4 show that it conforms with Parts II and III of this Annex as regards metrological and technological characteristics;

(c) after the thermal shock resistance test and after each accelerated endurance test, no variation in relation to the initial curve greater than 1·5 % between Q_t and Q_{max} or greater than 3 % between Q_{min} and Q_t has been observed.

The EEC pattern-approval certificate may lay down rules of equivalence enabling initial verification to be carried out with cold water.

VI. EEC INITIAL VERIFICATION

6.1. *Verification methods*

EEC initial verification will be carried out in a place approved by the metrological service of the Member State.

The layout of the premises and the test equipment should be such that verification may be carried out in safe, reliable conditions, and with no loss of time for the person responsible for the control. The provisions of item 5.2.3 must be complied with, except with respect to temperatures in the event of the tests being carried out with cold water in accordance with such provisions as may be laid down in the EEC pattern-approval certificate. Arrangements may be made at the test centre to enable the meters to be tested in series. The exit pressure of all the meters should always be sufficient to prevent cavitation and special measures may be required to prevent interference between meters.

The complete unit may include automatic devices, bypass valves, flow-restrictors, etc., provided that each test circuit between the meters to be verified and the control tanks is clearly defined and that it is possible to verify at any time its internal pressure absorption.

Any type of water-supply system may be used, but if several test circuits are operated in parallel, there should be no interference incompatible with the provisions of item 5.2.3.

If a control tank is divided into several chambers, the separating walls should be sufficiently rigid to ensure that the volume of a chamber does not vary by more than 0·2 % according to whether the adjacent chambers are full or empty.

6.2. *Inspection operations*

The meters must conform to an approved pattern.

Conformity with this pattern may be verified by a random sample inspection of the various components during manufacture and assembly or by opening one of the meters submitted.

Verification includes a leak-tightness test, which may be carried out with cold water, and an accuracy test normally conducted with hot water at a temperature of 50 °C (± 50 °C) and at least three flowrates:

(a) between 0·9 Q_{max} and Q_{max};

(b) between Q_t and 1·1 Q_t;

(c) between Q_{min} and 1·1 Q_{min}.

Where the EEC pattern-approval certificate permits, initial verification of a hot-water meter may be carried out with cold water in accordance with the procedures laid down in the certificate.

More specifically, the latter may increase, reduce and/or re-set the maximum permissible errors to allow for the effect of the temperature and pressure of the water on the measured results. For the same reason, it may, for the purpose of the initial verification tests, specify different values of Q_{min}, Q_t and Q_{max} from those laid down for the metering of hot water.

During the leak-tightness test, carried out for one minute at 1·6 times the maximum operating pressure, there must be no leakage or seepage through the walls of the meters.

If the accuracy tests consist in comparing the meter indicator reading against that of the reference standard, the volume of water passed through the meter in each test should be sufficient to rotate the pointer or roller on the verification scale through a complete series of revolutions and should be such that periodic errors are negligible. Any other inspection procedure may be used, on condition that it is provided for in the pattern approval certificate and gives an accuracy of measurement at least equivalent to that assured by the foregoing rule.

The first of the accuracy tests involves the determination of pressure loss, which should be less than the value indicated in the EEC pattern-approval certificate.

The maximum permissible errors are as shown in item 2.1.

If all the errors are found to lie in one direction, the water meter shall be adjusted so that not all the errors exceed one-half of the maximum permissible error, in so far as the EEC pattern-approval certificate does not lay down special provisions on the subject.